

What is claimed is:

1 1. An optical cross-connect apparatus, comprising:  
2       a light switch having  $n$  ( $n$  is a natural number of 2 or  
3 more) pieces of first port and at least  $(n + 1)$  pieces of second  
4 port, which switches paths of light signals inputted from each  
5 of said first ports and has them outputted from any one of  
6 said second ports;

7       a light path control section for branching a path of said  
8 light switch so as to have light signals inputted from any  
9 one of said first ports outputted from any two of said second  
10 ports; and

11       a light signal supervising section for supervising  
12 quality of light signals outputted from either of said two  
13 ports.

1 2. An optical cross-connect apparatus, according claim 1  
2 further comprising:

3       a light amplifying section for amplifying light signals  
4 outputted from either of said two ports; wherein  
5       the light signal supervising section for supervising  
6 quality of light signals amplified by this light amplifying  
7 section.

1 3. An optical cross-connect apparatus, comprising:

2       a light switch having a plurality of first and second  
3 ports, which switches paths of light signals inputted from

4 each of said first ports and has them outputted from any one  
5 of said second ports;

6 a light path control section for branching a path of said  
7 light switch so as to have light signals inputted from any  
8 one of said first ports outputted from any two of said second  
9 ports when supervising said light signals and have light  
10 signals inputted from each of said first ports outputted from  
11 predetermined one of said second ports when not supervising  
12 said light signal; and

13 a light signal supervising section for supervising  
14 quality of light signals outputted from either of said two  
15 ports only when performing said supervising.

1 4. An optical cross-connect apparatus, comprising:

2 a wavelength separating section for separating, per  
3 wavelength component, wavelength multiple light wherein light  
4 signals of a plurality of mutually different wavelength  
5 components are multiplexed;

6 a light switch having n (n is a natural number of 2 or  
7 more) pieces of first port and at least (n + 1) pieces of second  
8 port, which switches light signals of the respective wavelength  
9 components separated by said wavelength separating section  
10 inputted from each of said first ports and has them outputted  
11 from any one of said second ports;

12 a light path control section for branching a path of said  
13 light switch so as to have light signals inputted from one  
14 of said first ports outputted from any two of said second ports;

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15        a light signal supervising section for supervising  
16    quality of light signals outputted from a predetermined third  
17    port of said two ports;

18        a wavelength component converting section for converting  
19    each individual light signal outputted from said second ports  
20    excluding said third port into a light signal of predetermined  
21    wavelength components; and

22        a wavelength multiplexing section for multiplexing per  
23    predetermined number these light signals converted by the  
24    wavelength component converting section.

1    5.   The optical cross-connect apparatus according to claims  
2 , wherein said light signal supervising section detects and  
3 supervises management information placed in an overhead  
4 section of a predetermined frame format.

1    6.   The optical cross-connect apparatus according to claim  
2 5, wherein said light path control section sets a path for  
3 having light signals to be supervised inputted from each port  
4 outputted from said two ports per port in order.

1    7.   The optical cross-connect apparatus according to claims  
2 3 , wherein said light signal supervising section detects and  
3 supervises management information placed in an overhead  
4 section of a predetermined frame format.

1    8. The optical cross-connect apparatus according to claim  
2    7, wherein said light path control section sets a path for  
3    having light signals to be supervised inputted from each port  
4    outputted from said two ports per port in order.

1    9. The optical cross-connect apparatus according to claims  
2    4 , wherein said light signal supervising section detects and  
3    supervises management information placed in an overhead  
4    section of a predetermined frame format.

1    10. The optical cross-connect apparatus according to claim  
2    9, wherein said light path control section sets a path for  
3    having light signals to be supervised inputted from each port  
4    outputted from said two ports per port in order.

1    11. An optical cross-connect apparatus, comprising:  
2         a light switch having a plurality of first and second  
3         ports, which switches paths of light signals inputted from  
4         each of said first ports and has them outputted from any one  
5         of said second ports and also switches paths of light signals  
6         inputted from each of said second ports and has them outputted  
7         from any one of said first ports;  
8         n pieces of upward light signal input and output terminals;  
9         n pieces of downward light signal input and output  
10      terminals;  
11         a first light circulator provided corresponding to each  
12      of said first ports for outputting upward light signals

13 inputted from each of the upward light signal input terminals  
14 to each corresponding port of said first ports and also  
15 outputting downward light signals inputted from each of said  
16 ports to said downward light signal output terminal;

17       a second light circulator provided corresponding to each  
18 of said second ports for outputting downward light signals  
19 inputted from each of the downward light signal input terminals  
20 to each corresponding port of said second ports and also  
21 outputting upward light signals inputted from each of said  
22 ports to said upward light signal output terminal;

23       a light path control section for branching a path of said  
24 light switch means so as to have light signals inputted from  
25 any one of said first ports outputted from any two of said  
26 second ports and also have light signals inputted from any  
27 one of said second ports outputted from any two of said first  
28 ports;

29       a first light signal supervising section for supervising  
30 quality of light signals outputted from a predetermined third  
31 port of any two of said first ports; and

32       a second light signal supervising section for supervising  
33 quality of light signals outputted from a predetermined fourth  
34 port of any two of said second ports.

1       12. The optical cross-connect apparatus according to claim  
2       11, wherein said first and second light signal supervising  
3       sections detect and supervise management information placed  
4       in an overhead section of a predetermined frame format.

1    13. The optical cross-connect apparatus according to claim  
2    11, wherein said light path control section sets a path for  
3    having light signals to be supervised inputted from any first  
4    or second port outputted from any two of said second or first  
5    ports per port in order.

1    14. The optical cross-connect apparatus according to claim  
2    12, wherein said light path control section sets a path for  
3    having light signals to be supervised inputted from any first  
4    or second port outputted from any two of said second or first  
5    ports per port in order.

1    15. A signal supervising method, comprising the steps of:  
2         a light switching of switching paths of light signals  
3         inputted from each of n (n is a natural number of 2 or more)  
4         pieces of first port and outputting them from any of at least  
5         ( $n + 1$ ) pieces of second port;  
6         a light path controlling of branching a path of said light  
7         switch so as to have light signals inputted from one of said  
8         first ports outputted from any two of said second ports;  
9         a light signal supervising of supervising quality of light  
10      signals outputted from either of said two ports.

1    16. A signal supervising method according claim 15, further  
2      comprising the steps of:

3        a light amplifying of amplifying light signals outputted  
4    from either of said two ports; wherein  
5        the light signal supervising of supervising quality of  
6    light signals amplified by this light amplifying process.

1    17. A signal supervising method, comprising the steps of:  
2        a light switching of switching paths of light signals  
3    inputted from each of a plurality of first ports and having  
4    them outputted from any one of a plurality of second ports;  
5        a light path controlling of branching a path of said light  
6    switch so as to have light signals inputted from any one of  
7    said first ports outputted from any two of said second ports  
8    when supervising said light signal and have light signals  
9    inputted from each of said first ports outputted from  
10   predetermined one of said second ports when not supervising  
11   said light signal; and  
12        a light signal supervising of supervising quality of light  
13   signals outputted from either of said two ports only when  
14   performing said supervising.

1    18. A signal supervising method, comprising the steps of:  
2        a wavelength separating of separating, per wavelength  
3    component, wavelength multiple light wherein light signals  
4    of a plurality of mutually different wavelength components  
5    are multiplexed;  
6        a light switching of switching light signals of the  
7    respective wavelength components separated by said wavelength

8 separating process inputted from each of n (n is a natural  
9 number of 2 or more) pieces of first port and having them  
10 outputted from any one of at least (n + 1) pieces of second  
11 port;

12 a light path controlling of branching a path of said light  
13 switch so as to have light signals inputted from one of said  
14 first ports outputted from any two of said second ports;

15 a light signal supervising of supervising quality of  
16 light signals outputted from a predetermined third port of  
17 said two ports;

18 a wavelength converting of converting each individual  
19 light signal outputted from said second ports excluding said  
20 third port into a light signal of predetermined wavelength  
21 components; and

22 a wavelength multiplexing of multiplexing per  
23 predetermined number these light signals converted by the  
24 wavelength component converting process.

1 19. The signal supervising method according to claims 15 ,  
2 wherein said light signal supervising process detects and  
3 supervises management information placed in an overhead  
4 section of a predetermined frame format.

1 20. The signal supervising method according to claims 19,  
2 wherein said light path control process sets a path for having  
3 light signals to be supervised inputted from each port  
4 outputted from said two ports per port in order.

1 21. The signal supervising method according to claims 17 ,  
2 wherein said light signal supervising process detects and  
3 supervises management information placed in an overhead  
4 section of a predetermined frame format.

1 22. The signal supervising method according to claims 21,  
2 wherein said light path control process sets a path for having  
3 light signals to be supervised inputted from each port  
4 outputted from said two ports per port in order.

1    23. The signal supervising method according to claims 18 ,  
2    wherein said light signal supervising process detects and  
3    supervises management information placed in an overhead  
4    section of a predetermined frame format.

1 24. The signal supervising method according to claims 19,  
2 wherein said light path control process sets a path for having  
3 light signals to be supervised inputted from each port  
4 outputted from said two ports per port in order.